THE EFFECT OF EARLY RELEASE FROM WATCHKEEPING AS A VIGILANCE INCENTIVE

by

John Nourse Meloy

United States
Naval Postgraduate School

THESIS

THE EFFECT OF EARLY RELEASE FROM WATCHKEEPING
AS A
VIGILANCE INCENTIVE

by

John Nourse Meloy

June 1970

The Effect of Early Release from Watchkeeping
as a
Vigilance Incentive

by

John Nourse Meloy
Major, United States Army
B.S., United States Military Academy, 1959

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL
June 1970

ABSTRACT

An experiment was performed to evaluate the effect of early release from watch as an incentive in a visual vigilance task. The task was the detection of a slightly larger deflection of a voltmeter needle making 60 deflections per minute. The duration of the vigil was 60 minutes, in 4 consecutive 15 minute increments. Ten target signals were presented in each increment. Ten subjects (Ss) in a control group performed the task without possibility of early release from watch. Ten Ss in an experimental group performed the identical task with the incentive of being released from watch at the end of any increment in which 90% of the target signals were detected. There was no significant difference between groups. There was a significant decrement over time for both groups at the .10 level. There was no significant difference in false alarm rate between groups or over time.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

In the years since World War II, the subject of the classical vigilance decrement has been researched continuously. It has been researched, discussed, and viewed from what seems to be every conceivable direction. The volume of experiments and reports on the subject has become almost staggering. Technological changes in monitoring equipment since the beginning of World War II have caused the subject of vigilance to be of ever increasing importance to both the military, with its obvious applications, and to industry. In spite of all the research, no complete answers have ever been found to the two most important questions; what causes the decrement, and how can performance best be improved. There are many theories, often conflicting, in answer to these questions, but no clear cut answers. The reason, of course, is the prime element involved in vigilance tasks, the human operator.

In recent years, the value of the results of laboratory conducted vigilance experiments has been questioned. One reason for the questioning is the conflicting opinions on what vigilance encompasses. Some researchers feel that it is the monitoring and detection of infrequently and randomly occurring events. Others feel that it encompasses both the detection and then either processing the information, making a decision, or taking some immediate action. If the second opinion is accepted, then most laboratory results are questionable, for most stop short of both tasks. This paper is based on the first opinion.

Another reason for questioning the results is the difference between laboratory conditions and operational, "real world" conditions. This aspect is discussed specifically later in this paper. One researcher

has gone so far as to state that "little or no evidence exists indicating that the oft-found decrement in the laboratory has a parallel in the industrial (or military) setting" [Smith and Luccaccini 1969]. Others agree that there are many artificialities in the laboratory, but if one generalizes with extreme caution, the results are meaningful [Chapanis 1967]. This author agrees with the second opinion and accepts the fact that a decrement in performance does exist in most vigilance tasks.

As to the question of what causes the decrement in performance, it is easy to merely say boredom and difficulty. It (the decrement) has been described variously as a function of signal frequency, duration of signal, duration of watch, detectability of signal, shift in response criteria, environment, expectancy, operator proficiency, or motivation, to mention just a few. It is most likely that it is a function of all of these elements, all of which deal with the fact that there is a human operator involved; not just any one or two. This paper is not concerned with determining the causes, but looks at one cause, motivation, and investigates if improvement in motivation, through the use of an incentive, can bring about improvement in performance.

Many incentives have been used in vigilance experiments in efforts to increase motivation, and thus performance. The most common incentive (and probably most effective in our society) is monetary. This incentive has consistently resulted in significantly improved performance [Bergum 1964, Yufer 1969]. Any type of reward for increased effort and performance is an incentive. One experiment used college students as subjects and used course credit as an incentive. The results indicated a significant

improvement in performance and suggested that any relevant incentive can be effective [Halcomb and Blackwell 1969].

The reward used in this experiment was to release the operator from his watch early if a certain level of correct detections was maintained. Percentage of correct detections was used as the primary measure of performance. The number of false alarms (commissive errors) was also analyzed as a secondary measure. And finally, the consistent result of past experiments, the "end-spurt" [Bergum and Lehr 1963], was briefly considered. This end-spurt, or "tailing-up" as it is called in this paper, is common at the end of a monitoring task when the subject has knowledge of the length of the vigil and the present point in the vigil. Apparently, alertness and interest increase as the operator knows he is about to be relieved.

II. METHOD

A. DESIGN

The visual signal monitoring task consisted of detecting a slightly larger than normal deflection of a voltmeter needle, a commonly used visual task under laboratory conditions [Jenkins 1958]. The voltmeter needle made 60 regular rightward deflections per minute. A deflection of 25 degrees was a normal deflection. A deflection of 32 degrees was the target signal. There were 40 target signals during a full 60 minute watch period. There were 10 target signals randomly assigned to each of four consecutive 15 minute increments, with the restriction that the minimum inter-target signal interval was .3 minutes.

Each S was provided with a stop watch so that he would know exactly how many minutes were left on his watch period. Each S was isolated visually from outside distractions and wore earphones with white noise to isolate him audibly.

The experiment was designed to evaluate the effect of an incentive on monitoring performance. The incentive in this case was the opportunity to be released early from watch if S had a high level of detection (90%) over any one 15 minute increment. Totally unknown to any S was the fact that he would not be released and would have to stand the full watch period regardless of detection level. Two secondary objectives were designed into the experiment; to look at false alarm rates and the "tailing-up" discussed earlier.

B. SUBJECTS

The Ss were 20 male military officer graduate students from the United States Naval Postgraduate School. Of the group, 9 were in the U. S. Army, 6 were in the U. S. Navy, and 5 were in the U. S. Marine Corps. They ranged in age from 26 to 39 years. None had participated in previous vigilance experiments, but all were aware of what a vigilance decrement was.

C. APPARATUS

The apparatus consisted of a display, response and recording equipment, signal generating equipment, and a white noise generator.

The display booth had a flat white back wall on which was mounted a black voltmeter. The face of the voltmeter was painted flat white with no markings; the needle black. The impulse circuit and damping characteristics of the meter were such that the deflection of the needle appeared as a rapid rise and fall of the needle with no bounce or pause at the top or bottom.

The S responded to any apparent target signal by pushing a silent button mounted on his table. Any response by S was recorded on a multi-pen recorder. All actual target signals were simultaneously recorded on the adjacent channel.

The normal deflections and the target signals were programmed on paper tape and stepped through an Ohr-tronics 8-channel tape reader at a rate of 60 characters per minute. This electrically energized the voltmeter and caused the deflections.

A white noise generator was connected to the Ss earphones, providing auditory isolation. This was adjusted between 20 and 60 db to the Ss' tolerance.

D. PROCEDURE

The Ss were randomly divided into a Control Group (C) and an Experimental Group (E), 10 Ss in each group. Each S within each group received identical individual instructions (Appendices A and B), explaining the nature of the task and response procedures. It should be noted that each S was specifically cautioned about false alarms. Each S participated in a 2 minute practice session consisting of 10 target signals, during which he was given knowledge of results, and was warned that the target signals would appear much more infrequently during his watch period. The S put on his earphones, the db level was adjusted to his tolerance, and the watch period began with no interruptions permitted.

Each S's recorded responses were checked for detections and false alarms. Any response within 2 seconds of a target signal was considered a correct detection.

At the end of the watch period, each S was asked the following two questions:

1. How did you interpret my statement that false alarms can be costly?

2. Do you personally feel that being released early from a task of this type was an incentive for being more alert?

In addition, Group E was asked if they believed that they really would be released early for a 90% detection level.

III. RESULTS

Two dependent variables were analyzed, the percentage of target signals detected and the number of false alarms. The allowable detection period of 2 seconds was not critical. All correct detection responses occurred within one second and all other responses were clearly false alarms.

A. DETECTIONS

The percentage of correct detections was analyzed from two viewpoints. The mean percentage of correct detections per time increment was analyzed, which is the common and most meaningful analysis. As a secondary analysis, the cumulative mean percentage of correct detections over time was analyzed. Figure 1 shows the mean percentage of correct detections as a function of time increments for both groups. Figure 2 shows the cumulative mean percentage as a function of time.

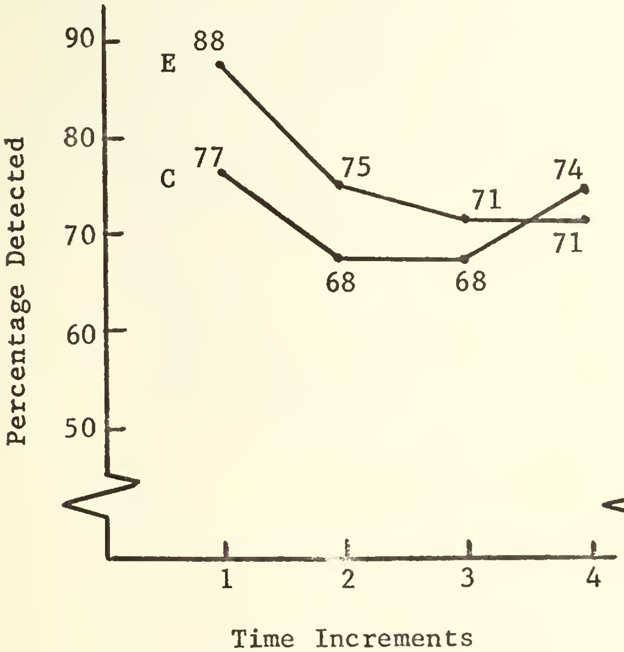

Figure 1. Mean Percentage of Detections as a Function of Time Increments

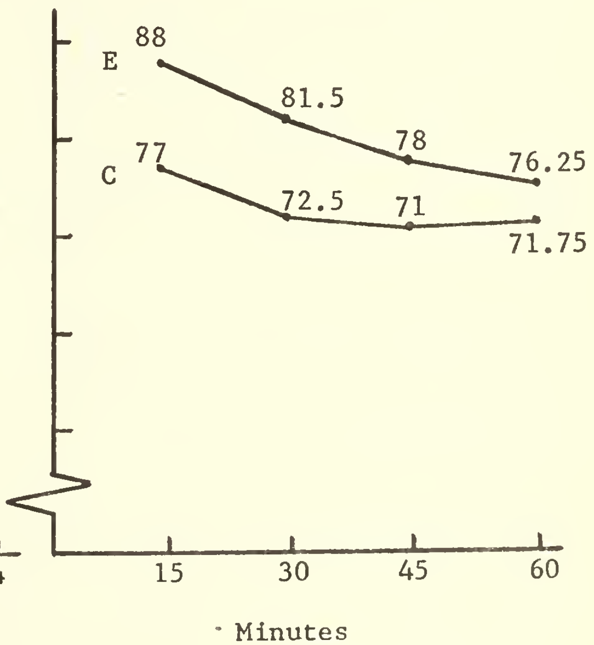

Figure 2. Cumulative Mean Percentage of Detections as a Function of Time

Except for increment 4 (figure 1), Group E maintained a higher level of correct detections. But no other conclusions could be drawn from this raw data.

In order to analyze whether Group E was significantly higher than Group C, these raw data were transformed to radians by the arcsine transformation [Winer 1962]. This was done to obtain normality of within-cell distributions and to obtain the additivity of effects needed in any analysis of variance model. The arcsine transformation is effective in stabilizing the variances. A partially nested analysis of variance was then performed on these transformed data, with Ss nested into groups, but common to all four time increments. The analysis of the mean percentage of correct detections per time increment is shown in Table I.

Table I. Analysis of Variance of Signals Detected - Per Time Increment

Source of Variance	df	MS	F	p
Between Ss	19			
Groups (G)	1	.4344	.2371	---
Error (Between)	18	1.8319		
Within Ss	60			
Time (T)	3	.491	2.5801	.10
G x T	3	.2296	1.2065	---
Error (Within)	54	.1903		
Total	79			

The observed F ratio less than 1 above (between G) is not a rare event, but it had to be investigated to determine if it was significantly less than one [Ostle 1963]. This was done by calculating the inverse of the

F ratio with the df reversed, i.e., $1/F_{(18,1)}$. In this case, the inverse at the .1 level equaled .016, concluding that it was not significantly less than one. If it had been significant, the additivity of the model would have been questionable.

From Table I, it was concluded that there was no significant difference in performance between groups. There was a significant decrement, or decline in performance, over the time periods at the .10 level, but none at the .05 level and above. There was no significant interaction between groups and time increments.

The analysis of the cumulative mean percentage of correct detections over time is shown in Table II.

Table II. Analysis of Variance of Signals Detected - Cumulatively Over Time

Source of Variance	df	MS	F	p
Between Ss	19			
Groups (G)	1	1.0478	.5754	---
Error (Between)	18	1.8211		
Within Ss	60			
Time (T)	3	.293	9.4212	.001
G x T	3	.0451	1.4502	---
Error (Within)	54	.0311		
Total	79			

The observed F ratio less than one was not significantly less than one. From Table II, the same conclusions were reached, with the exception that the decrement over time was significant up through the .001 level.

B. FALSE ALARMS

Figure 3 shows the mean percentage of false alarms, both by time increment and cumulatively over time. This was calculated from the fact that there were 900 deflections per 15 minute increment, minus the 10 target signals, leaving 890 possible false alarms per time increment.

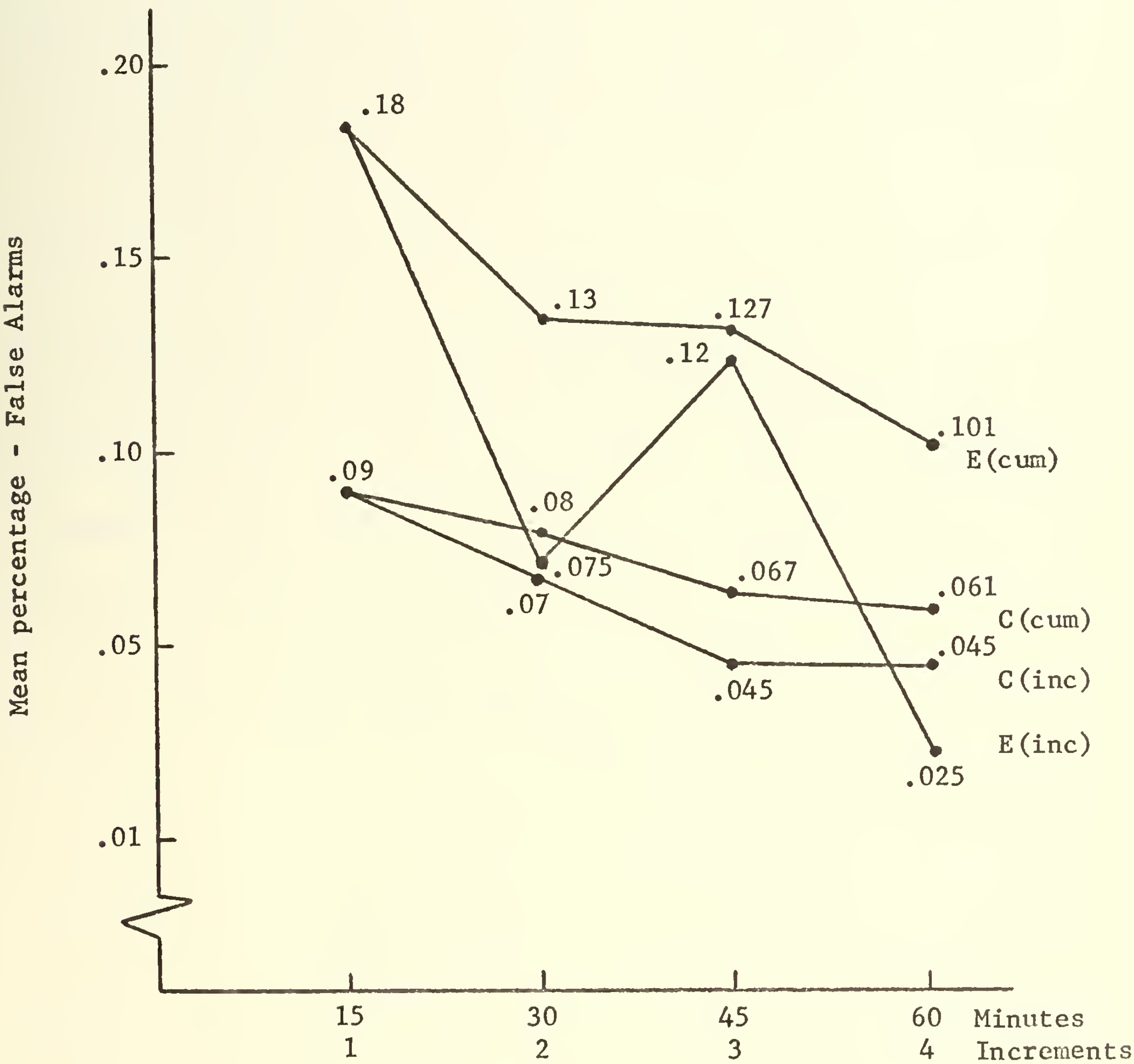

Figure 3. Mean Percentage of False Alarms Cumulatively over Time and per Increment

Table III shows the total false alarms by subject and by group. The fact that Group E made almost twice as many false alarms as Group C seemed to indicate that there was a difference in false alarm rates between groups.

Table III. Total False Alarms - by Group and Subject

Group	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	Total
C	0	9	2	0	0	5	0	3	3	0	22
E	0	4	1	15	7	0	1	5	2	1	36

The overall median for the two groups was found to be 1.5. The data were cast into a 2 x 2 contingency table as shown in Table IV, and a non-parametric median test, to measure differences in central tendency between two independent groups, indicated that no significant difference existed between the two groups at any level.

Table IV. False Alarm Data - Between Groups

	Group	
	C	E
Above Median	5	5
Below Median	5	5

The false alarm data were then cast into a 2 x 4 contingency table over time, as shown in Table V, and a non-parametric extension of the median test was conducted to analyze any differences in false alarm rate over time. This test indicated that no significant difference existed.

Table V. False Alarm Data - Over Time

	Time Period				
	1	2	3	4	Total
Above	7	2	4	2	15
Below	13	18	16	18	65
Total	20	20	20	20	80

IV. DISCUSSION

Prior to drawing any conclusions, it is felt that there are certain aspects of this experiment, and indeed of any similar type experiment, that need to be noted and considered. When reading the results and conclusions of a vigilance experiment conducted in the laboratory, the differences between laboratory conditions and "real world" operational conditions must be kept constantly in mind.

The visual signal monitoring task in this experiment was designed to have such a degree of monotony and difficulty as to obtain, as nearly as possible, the results of an operational task, such as radar monitoring. However, in this experiment, the detection of the target signal was a "one-shot" affair; the S either detected the signal or he did not detect it. There was no second chance. A radar operator may miss a signal on one sweep and detect it on the next sweep, with no real cost involved.

The populations must be considered. The Ss used were officer graduate students; trained, educated and presumably motivated to give a good performance in any task assigned. All of these factors are not necessarily present in an operational situation. No matter how boring and difficult the task, the Ss knew that they would be on watch for a maximum of one hour; they would not have to be coming back for watch after watch. This certainly affected motivation. They knew they could "gut it out" for one hour and it would be all over. Obviously, the radar operator does not have this motivation. Additionally, the Ss were all acquaintances of the experimenter which may have very well affected their conscientiousness and motivation.

Finally, the design of this experiment included knowledge of results, in a negative sort of way. The Group E _S_s assumed at the end of each 15 minute increment that they had _not_ detected 90% of the target signals. A radar operator would not have even this type of feedback. How it affected the _S_s performance in the next 15 minute increment can be only speculative. It was hoped that it would cause the _S_ to be even more alert the next increment, especially since this was mentioned in his instructions (Appendix B).

The questions asked each _S_ after his watch period were strictly for fringe interest purposes and the exact answers were not recorded. However, every _S_ gave basically the same answers.

On the questic . of interpretation of false alarm cost, each _S_ felt that false alarms would somehow detract from their credit for correct detections. Some even felt that one false alarm would cause them to lose credit for one correct detection. Others felt that it would take a number of false alarms to lose correct detection credit. It is therefore believed that this was a prime factor in the resulting extremely low false alarm percentages compared to past results.

On the question of the value of the incentive, the answer was a unanimous yes; anything to get away from that "bouncing needle." The results certainly indicate there was _some_ value to the incentive; Group E had higher detection percentages than Group C, except for time increment 4. So, overall, they may have been "more alert," just not significantly more alert statistically.

In answer to the additional question asked of Group E, they all believed that they were being told the truth; however, after the second time increment, they started getting discouraged and after the third, it did not matter.

Referring back to Figure 1, it appears to corroborate the answers to question 2 and the additional question asked of Group E. Group E did start out performing better, but the disappointment at not being released at the end of time period 1 or 2 caused them to continue to drop closer to Group C in performance. The "it does not matter" attitude could account for their remaining at the same level of detection in time increment 4, rather than "tailing-up" as expected. The hoped for tailing-up near the end of each time increment, and thus maintaining a consistently high level of detection, apparently did not occur. The tailing-up at the end of the watch period obviously did occur, as expected, with Group C. It should be pointed out that the stop watch was purposely given to Group E so that they would know when they were nearing the end of each time increment. Apparently they had not read past results and thus did not behave accordingly.

The fact that a significant decrement over time periods only occurred through the .10 level and not through the .01 or .001 level, as one would normally expect, based on past experiments, is noteworthy. It is felt that this can be primarily attributed to the factors discussed earlier in this section; subject population, motivation, education, etc. It is interesting to compare the analysis per time increment and cumulatively over time and note that in the second case, the decrement in performance was significant through the .001 level. Perhaps this second analysis is more meaningful than previously thought.

It should be pointed out that the non-parametric median and extension of the median tests used to analyze the false alarm data, though less powerful statistically than a parametric test such as the chi-square goodness of fit, are more meaningful. The median tests tend to lessen the effect of a large number of false alarms made by a few subjects [Poock and Wiener 1966].

V. CONCLUSIONS

The general level of performance in a visual signal monitoring task of the type used in this experiment was not significantly enhanced through the incentive of early release from watchkeeping duties. Considering the differences between laboratory and operational conditions, it is still felt that the conclusions would be the same in an operational environment. That is to say, this experiment may have produced higher detection percentages than the same experiment conducted in an operational situation, but the analytical results would have remained the same. The observation of a vigilance decrement over time was supported by this experiment, as well as the observation of a "tailing-up" in performance near the end of a known watch period.

APPENDIX A. INSTRUCTIONS TO SUBJECTS: CONTROL GROUP

This experiment is designed to measure the effect of early release from watch as an incentive for increasing alertness in a visual signal monitoring task. You are a member of the control group and, as such, will stand a full 60 minute watch with no opportunity for early release.

In front of you is a voltmeter with no markings on its face. Do not touch the needle or face. The red button on the table is your response button. The stop watch is for your use in timing the watch period if you desire. During your watch the needle will be deflected at a rate of one deflection per second like this (5 second demonstration). This deflection is a normal deflection. At random and infrequent times during your watch, the needle will deflect more to the right than normal. That will be a target signal. Anytime you see a target signal, immediately push your response button.

Your task is to detect and report as many of the target signals as you can. Avoid false alarms; they can be costly. The target signals will occur very infrequently and will be brief, so you must remain alert and watch carefully.

A two minute demonstration will now be given. There will be 10 target signals during this demonstration. I will tell you after each if you got it or not. Watch the meter and respond as soon as you detect a target signal. (Demonstration)

Remember, the target signals will occur much more infrequently during your watch period.

Are there any questions? We will now begin. You will be told when the watch period is over. Stay alert and watch the meter.

APPENDIX B. INSTRUCTIONS TO SUBJECTS: EXPERIMENTAL GROUP

This experiment is designed to measure the effect of early release from watch as an incentive for increasing alertness in a visual signal monitoring task. You are a member of the experimental group and, as such, will have the opportunity to be released early from the normal 60 minute watch.

In front of you is a voltmeter with no markings on its face. Do not touch the needle or face. The red button on the table is your response button. The stop watch is for your use in timing the watch period. During your watch the needle will be deflected at a rate of one deflection per second like this (5 second demonstration). This deflection is a normal deflection. At random and infrequent times during your watch, the needle will deflect more to the right than normal. That will be a target signal. Any time you see a target signal, immediately push your response button.

Your task is to detect and report as many of the target signals as you can. Your watch period is broken down into 4 consecutive 15 minute increments, with no break in between. If, during any <u>one</u> 15 minute increment, you maintain a 90% or better detection level, you will be released from watch at the end of that increment. Do not stop and ask me at the end of an increment how you did. I will immediately release you if you <u>did</u> maintain a 90% detection level. Otherwise, you were not successful and should try to be more alert during the next 15 minute increment. Avoid false alarms; they can be costly. The target signals will occur very infrequently and will be brief, so you must remain alert and watch carefully.

A two minute demonstration will now be given. There will be 10 target signals during this demonstration. I will tell you after each if you got it or not. Watch the meter and respond as soon as you detect a target signal. (Demonstration)

Remember, the target signals will occur much more infrequently during your watch period.

Are there any questions? We will now begin. Stay alert and watch the meter.

BIBLIOGRAPHY

Baker, R. A. and Ware, J. R., "The Relationship Between Vigilance and Monotonous Work," Ergonomics, v. 9, p. 109-114, 1966.

Bergum, B. O., "Vigilance: A Guide to Improved Performance," HumRRO Research Bulletin, No. 10, 1963.

Bergum, B. O. and Lehr, D. J., "End-spurt in Vigilance," Journal of Experimental Psychology, v. 66, p. 383-385, 1963.

Bergum, B. O. and Lehr, D. J., "Monetary Incentives and Vigilance," Journal of Experimental Psychology, v. 67, p. 197-198, 1964.

Chapanis, A., "The Relevance of Laboratory Studies to Practical Situations," Ergonomics, v. 10, p. 557-577, 1967.

Criswell, D. L., The Effect of Reference Signals in a Visual Vigilance Task, M.S. Thesis, Naval Postgraduate School, Monterey, California, 1969.

Halcomb, C. G. and Blackwell, P., "Motivation and the Human Monitor: 1. The Effect of Contingent Credit," Perceptual and Motor Skills, v. 28, p. 623-629, 1969.

Hicks, C. R., Fundamental Concepts in the Design of Experiments, Holt, Rinehart, and Winston, 1964.

Human Factors Research, Inc., Technical Report 1, Review and Critique of the Literature on Vigilance Performance, by J. J. McGrath, A. Harabedian, and D. N. Buckner, 1959.

Jenkins, H. M., "The Effect of Signal-Rate on Performance in Visual Monitoring," The American Journal of Psychology, v. 71, no. 4, p. 647-661, 1958.

Jerison, H. J. and Pickett, R. M., "Vigilance: A Review and Re-evaluation," Journal of the Human Factors Society, v. 5, p. 211-238, 1963.

Luccaccini, L. F., Freedy, A. and Lyman, J., "Motivational Factors in Vigilance: The Effects of Instructions on Performance in a Complex Vigilance Task," Perceptual and Motor Skills, v. 26, p. 783-786, 1968.

Mackworth, J. F. and Taylor, M. M., "The d' Measure of Signal Detectability in Vigilance-Like Situations," Canadian Journal of Psychology, v. 17, p. 302-325, 1963.

Mackworth, J. F., "Deterioration of Signal Detectability During a Vigilance Task as a Function of Background Event Rate," Psychonomic Science, v. 3, p. 421-422, 1965.

Mackworth, J. F., "The Effect of Signal Rate on Performance in Two Kinds of Vigilance Tasks," Journal of the Human Factors Society, v. 10, p. 11-17, 1968.

Mackworth, N. H., "The Breakdown of Vigilance During Prolonged Visual Search," Quarterly Journal of Experimental Psychology, v. 1, p. 6-21, 1948.

Ostle, B., Statistics in Research, 2d ed., p. 301-302, The Iowa State University Press, 1963.

Poock, G. K. and Wiener, E. L., "Music and Other Auditory Backgrounds During Visual Monitoring," The Journal of Industrial Engineering, v. 17, no. 6, p. 318-323, 1966.

Seigel, S., Nonparametric Statistics, McGraw-Hill, 1956.

Smith, R. L. and Luccaccini, L. F., "Vigilance Research: Its Application to Industrial Problems," Human Factors, v. 11, p. 149-156, 1969.

Taylor, M. M., "Detectability Measures in Vigilance: Comment on a Paper by Wiener, Poock, and Steele," Perceptual and Motor Skills, v. 20, p. 1217-1221, 1965.

U. S. Army Human Engineering Laboratories, Vigilance: An Annotated Bibliography, by C. G. Halcomb and P. J. Blackwell, November 1969.

Wiener, E. L., "Knowledge of Results and Signal Rate in Monitoring: A Transfer of Training Approach," Journal of Applied Psychology, v. 47, p. 214-222, 1963.

Wiener, E. L., Poock, G. K., and Steele, M., "Effect of Time-Sharing on Monitoring Performance: Simple Mental Arithmetic as a Loading Task," Perceptual and Motor Skills, v. 19, p. 435-440, 1964.

Wilson, J. C., "An Investigation of Vigilance in the Rhesus Monkey," Quarterly Journal of Experimental Psychology, v. 17, p. 110-117, 1965.

Winer, B. J., Statistical Principles in Experimental Design, McGraw-Hill, 1962.

Yufer, K. L., The Effect of Monetary Incentives on Monitoring Performance, M.S. Thesis, Naval Postgraduate School, Monterey, California, 1969.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Documentation Center Cameron Station Alexandria, Virginia 22314	2
2.	Library, Code 0212 Naval Postgraduate School Monterey, California 93940	2
3.	Associate Professor Gary K. Poock, Code 55Pk Department of Operations Analysis Naval Postgraduate School Monterey, California 93940	1
4.	MAJ John Nourse MELOY, USA 3188 Tallmon Street Marina, California 93933	1
5.	Department of Operations Analysis Department Library, Code 55 Naval Postgraduate School Monterey, California 93940	1

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Naval Postgraduate School Monterey, California 93940	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE

The Effect of Early Release from Watchkeeping as a Vigilance Incentive

4. DESCRIPTIVE NOTES (Type of report and, inclusive dates)

Master's Thesis; June 1970

5. AUTHOR(S) (First name, middle initial, last name)

John N. Meloy

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
June 1970	30	27

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO	
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10. DISTRIBUTION STATEMENT

This document has been approved for public release and sale; its distribution is unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Naval Postgraduate School Monterey, California 93940

13. ABSTRACT

An experiment was performed to evaluate the effect of early release from watch as an incentive in a visual vigilance task. The task was the detection of a slightly larger deflection of a voltmeter needle making 60 deflections per minute. The duration of the vigil was 60 minutes, in 4 consecutive 15 minute increments. Ten target signals were presented in each increment. Ten subjects (Ss) in a control group performed the task without possibility of early release from watch. Ten Ss in an experimental group performed the identical task with the incentive of being released from watch at the end of any increment in which 90% of the target signals were detected. There was no significant difference between groups. There was a significant decrement over time for both groups at the .10 level. There was no significant difference in false alarm rate between groups or over time.

DD FORM 1 NOV 65 1473 (PAGE 1)

S/N 0101-807-6811

A-31408

Security Classification

KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
rement						
-Spurt						
se Alarms						
entive						
itoring						
nal Detection						
nal Monitoring						
ue of Laboratory Results						
ilance						
ual Signals						

FORM 1 NOV 68 1473 (BACK)
101-807-6821

Security Classification

A-31409

Meloy

The effect of early release from watch-keeping as a vigilance incentive.

Meloy

The effect of early release from watch-keeping as a vigilance incentive.